

## Flat Panel Display papers

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### ASIAN TECHNOLOGY INFORMATION PROGRAM (ATIP)

REPORT: Flat Panel Display papers

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ABSTRACT. Papers on the state of the art in flat panel display technology from Mita Press, Optoelectronics Devices & Technologies, Vol 7 No 2 Dec 1992.

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Mita Press

Ochanomizu Center Building

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publishes a journal "Optoelectronics, Devices and Technologies", in English (ISSN 0912-5434). The Dec 1992 issue, Vol 7, No 2, is a special issue devoted to Flat-Panel Displays. Six papers from Japan and five from other countries (The Netherlands, Germany, Switzerland, France, England, and the Ukraine) are featured. In addition there are three short "Forum" articles from Japanese scientists giving their opinion on future prospects. For those interested in flat panel displays I recommend this particular issue highly. Below I have reproduced the abstracts of the papers and the titles of the Forum articles.

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### A FLAT CRT BASED ON AN ARRAY OF p-n EMITTERS

Harry J LIGTHART, Gerard G. P. VAN GORKOM, and Arthur M. E. HOEBERECHTS

Philips Research Laboratories

5600 JA Eindhoven, The Netherlands

Abstract: A description of a flat, slim CRT on the basis of an array of silicon cold cathodes (p-n emitters) is given. The cathodes are positioned at the bottom of the display. The electron beams produced by these emitters are focussed and deflected over 90 degrees by an electron optical system to enter a drift region. In this region the electrons travel parallel to the mask and the phosphor screen. Horizontal picture

lines are addressed by deflecting the beams electrostatically toward the mask using a set of e.g. 16 horizontal electrodes. The colours are selected by manipulating the angle of the beams at the mask. After passing through the holes in the mask, the electrons are accelerated toward the phosphor screen. The technology and the processing of experimental tubes are described, as well as the electronic hardware to drive the displays. First results obtained with these displays are presented, and the factors determining the attainable picture quality are discussed.

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## IMPROVEMENT OF IMAGE QUALITY OF LARGE MATRIX-DRIVEN COLOR FLAT PANELS

Kinzo NONOMURA and Kaoru TOMII

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**Abstract:** A review is given of recent progress in large matrix-driven color flat-type cathode ray display panels. A recent remarkable technological achievement has been various improvements to make the boundaries between units less visually conspicuous and to simplify the assembly of the previously reported MDS-CFP (Matrix Drive and Deflection System Color Flat Panel) that consists of multiple flat panel units. A new, highly accurate electron beam control system for attaining a higher overall image uniformity on large-size MDS-CFPs has accomplished substantial improvement in the uniformities of both luminance and color purity. A range of specifications for the optimum beam-spot diameter, accuracy of horizontal beam-landing, and other factors are presented. Finally a new beam-landing correction method for improving the accuracy of panel assembly work is introduced and discussed.

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## TECHNICAL TRENDS IN VACUUM FLUORESCENT DISPLAYS

Kazuya KINOSHITA, Shigeaki KIKUTA, Sashiro UEMURA, and Kazuhiko KASANO

Ise Electronics Corporation

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**Abstract:** The technology of vacuum fluorescent display (VFD) has been greatly improved since its development in 1967. Many new applications are based on advanced technologies such as photolithographic formation of insulating layer and phosphor layer, anti-vibration suspension of long-span filament cathodes, improvement of phosphors, and so on. Beautiful color pattern displays are used in game displays because

of their vivid colors and capability of flexible pattern formation. For use in public information or message systems, a wall-mounted big panel that uses panel stacking has been developed. The method has solved the size restriction of the VFD, and big panels are used for bank interest and stock rate information display systems in large quantities. Adoption of active matrix and field emitter arrays is being studied for use in the next generation of display.

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#### LIQUID CRYSTAL FLAT PANEL DISPLAYS

Tomio WADA and Mitsuhiro KODEN

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**Abstract:** Liquid crystal devices continue to grow in importance in a variety of display applications, ranging from flat panel displays to projection light valves. The recent development of liquid crystal displays has achieved high information content, high resolution, large size, and full color capability. This report describes the developmental history and market trends of liquid crystal flat panel displays. It also describes active-matrix liquid crystal displays with thin film transistors that are already well established in OA and AV applications and, as the ultimate product, a wall-mounted TV.

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#### RGB MULTI-COLOR LED DOT-MATRIX UNITS AND THEIR APPLICATION TO LARGE-SIZE FLAT DISPLAYS

Kazuyuki KOGA, Yasuhiro UEDA, Yasuhiko MATSUSHITA, Takahiro UETANI,  
Tatsuya KUNISATO, Takao YAMAGUCHI, and Tatsuhiko NIINA  
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**Abstract:** A practical 16 x 16 RGB multi-color LED dot-matrix unit has been developed using anode-common type full-color LED lamps as pixels for the first time. This unit is compactly designed with internal driving circuitry, and it can display 7 colors (red, orange, yellow, green, blue, pink and white). A large-size RGB multi-color flat display system has also been fabricated by assembling 24 of these units. This system can display colorful moving-images by means of a personal computer. The brightness of the white color is 140 cd/m<sup>2</sup>, which is estimated to be sufficient for indoor display use.

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#### PLASMA DISPLAY PANELS

Tsutae SHINODA  
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**Abstract:** The technologies, the present state, and the future prospects of plasma displays are reviewed. Monochrome plasma displays have been developed for use in office and factory automation, and have played an important role in making equipment more compact. 640x480 and 640x 400 panels have been developed as standard display devices for personal computers, and a 1280 x 1024 panel has been developed for work station terminals. A 1.5 m-diagonal plasma display is the largest of the direct view displays which has been developed. The market, however, is not yet so large, because a color device has not yet been realized. A three-color plasma display has been commercially available for use on the stock market since 1990, and a full-color display has been developed for use in HDTV. Aspects such as high luminance, high luminous efficiency, life, enlargement, high resolution, and gray scale are problems for HDTV. The present investigation supports the contention that color plasma display is the most promising device for use in large-size direct-view wall-hanging HDTV.

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#### LIQUID CRYSTAL MIXTURES FOR SUPER TWISTED NEMATIC

Micha J. JUNGE, Bernhard RIEGER, and Georg WEBER  
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Industrial Chemicals Division  
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**Abstract:** STN panels are widely used for displays with high information content. Recent inventions allow fast switching STN displays with good contrast. Inspired by these new developments in STN technology, we will discuss in this paper topics influencing mixture formulation for low and high multiplex STN displays, as well as the parameters influencing response times. Materials for fast switching STN mixtures also will be presented.

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#### THE EFFICIENT OPTICS OF LIQUID CRYSTAL POLARIZED COLOR PROJECTION

Jurg FUNFSCHILLING, and Martin SCHADT  
Department of RLCR  
F. Hoffmann-La Roche Inc.  
CH-4002, Basel, Switzerland

**Abstract:** The improvement in the performance of liquid crystal display (LCD)-projectors which results from using the recently presented liquid crystal polarized color projection (LC-PCP) concept is demonstrated in combination with standard slide projection optics. An increase of 40% of the useful light throughput in the selective reflection regions of the cholesteric filters (polarizers) is demonstrated. Moreover, high brightness and large contrast ratios are shown to result in LCD projectors from combining twisted nematic (TN)-LCDs with cholesteric filters/polarizers, quarter wave plates and conventional linear polarizer sheets.

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## TWO-TERMINAL DEVICE ADDRESSED LCD

Seigo TOGASHI

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**Abstract:** This paper describes the latest two-terminal switching device addressed LCDs. Simple structure MIM diodes as two-terminal devices are fabricated with a process of two masking steps. An optimized 4-level drive scheme with two independent offset voltages is proposed. Compared with a conventional fabrication process with three masking steps, this new process skips the deposition of a top metal layer and makes the pixel ITO layer play the role of the top metal. This process has the potential of high yield and low production cost. The MIM diodes with this process have high drive ability compared to the conventional diodes, however, they also have asymmetric characteristics. In order to maximize the dynamic range of drive voltage and eliminate the influence of these asymmetric properties that apply DC components on the LC layer, two independent offsets for the select and the hold voltages are introduced to 4-level drive waveforms. The writing and hold characteristics for a matrix addressing are precisely investigated, and the effects of dynamic capacitance of MIM diodes on the drive performance are analyzed. The LCDs addressed by the MIM diodes have large drive ability and broad tolerance for capacitance ratio in cases where the drive conditions are optimized. For proving the high performance of the MIM diodes, prototypes of the LCDs are demonstrated.

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## TWO-MASK a-Si:H TFT MATRIX FOR ACTIVE LIQUID CRYSTAL DISPLAYS.

Michel LE CONTELLEC and Francois MORIN

CNET-LANNION B

Departement OCM/TEP

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**Abstract:** We have developed a very simple process for active matrix

fabrication with only two photolithographic steps. This technology is based on the top-gate structured TFT which exhibits characteristics similar to those of TFT prepared by a conventional process. As the TFT is not light-shielded, an amorphous silicon layer as thin as 150 Å can be used to decrease the photosensitivity of the semiconductor, doing this, the contrast ratio of the display remains constant under illumination of up to 40 klux. Different displays, including a 10.4" VGA colour display, have been simulated and fabricated.

The fabrication yield has been measured for 4.5" colour displays on a pilot production line. High values were derived for the matrix test and the final control of panel performance. This short process gives a matrix cost advantage of nearly 50% over standard manufacturing procedures.

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#### LOW TEMPERATURE POLY-SI FOR LIQUID CRYSTAL DISPLAY ADDRESSING

John R. A YRES, Stanley D. BROTHERTON, and Nigel D. YOUNG

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Redhill, Surrey, RH1 5HA, England

**Abstract:** Poly-Si TFT technology represents an important route for the future development of flat panel displays by enabling the integration of addressing and clocking circuitry onto the active plate. Two technologies have emerged to do this: either by local laser annealing in the circuit areas or by a monolithic approach using poly-Si for the array and the circuit TFTs. Some of the issues associated with this latter approach are discussed in this paper, including leakage currents, plasma hydrogenation, device stability and grain boundary measurements and modelling.

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#### NONCOOLED INFRARED MAGNETOINJECTION EMITTERS BASED ON $\text{Cd}_{1-x}\text{Hg}_x\text{Te}$

Vladimir MALYUTENKO, Aleksandr PIGIDA, and Evgeny YABLONOVSKY

Institute of Semiconductors

Ukrainian Academy of Sciences

252650, Kiev-28, Ukraine

**Abstract:** The magnetoinjection emitters with active  $\text{Cd}_{1-x}\text{Hg}_x\text{Te}$  elements ( $x=0.20-0.30$ ) have been studied for their parameters. It is shown that, unlike the classical light-emitting diodes, the magnetoinjection emitters prove to be quite powerful radiation sources for the middle IR region even at room temperature. Such emitters are fast-response; they can have a larger emitting surface and permit the realizing of light signals of positive and negative contrast relative to the level of their equilibrium emission. By varying the  $\text{Cd}_{1-x}\text{Hg}_x\text{Te}$  composition, a range of wavelengths from 4 to 9  $\mu\text{m}$  can be covered.

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## Forum Articles

### Hurdles in the Development of Large-area Liquid Crystal Displays

Eiji KANEKO

Giant Electronics Research Laboratory

GTC Co.

Higashi-Nihonbashi, Sato Bldg., 1-6-5 Higashi-Nihonbashi

Chuo-ku, Tokyo 103 Japan

### Liquid Crystal Displays vs. Plasma Displays

Takehiro KOJIMA

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### Molecular Thin Film Devices for Future Optoelectronics

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## END OF REPORT

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